REMARKS

Introduction

Claims 1, 2, 4-13 and 15-23 are pending. Claims 3 and 14 are cancelled. Claims 22 and 23 are new.

New claims 22 and 23 depend from claim 21 and recite creep strain percentages for the claimed part. Support for these claims is found in Example 2 in the specification, particularly in the paragraphs and Tables 3-5 on pages 7-8. No new matter has been added.

Claim Rejections – 35 U.S.C. §103(a)

SU '633

Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 1, 2, 4-13 and 15-21 under 35 U.S.C. §103(a) as being unpatentable over SU 348633 (SU '633).

Applicant respectfully submits that SU '633 does not teach or suggest the claimed invention. The purpose of the invention is to provide a material with good high temperature creep behavior and sufficient ductility.

As applicant has previously stated, the magnesium content in SU'633 is higher than the presently claimed magnesium content. The magnesium content disclosed in SU '633 is not acceptable for application in diesel cylinder heads, as such a level of Mg content does not provide acceptable high temperature creep behavior and sufficient ductility.

Additionally, the SU'633 alloy contains boron, beryllium, and 0.1 – 0.2% mischmetal. The alloy of claim 1 does not contain these elements, and they are *explicitly excluded from claim 21* by the recitation of the phrase "consisting essentially of." The attached abstract shows the effect of the addition of lanthan based rare earths (Figs. 16

and 17) on hardness (higher curve), elongation (medium curve) and tensile strength (lower curve). The comment on page 22 of the abstract states that, for PMGC cast parts, the addition of 0.2 to 0.75 % rare earth leads to a simultaneous increase in tensile strength and elongation. The same conclusion applies to Fig. 17 (with 0.2 to 0.5 % addition). However, in all classical metallurgical systems, an increase in strength via Cu or Mg addition is systematically linked to a decrease in elongation, and this should be the case of the alloys corresponding to the invention. Thus, metallurgical systems with and without rare earths are clearly different and incomparable, such that one of ordinary skill in the art would not even consider such an alloy to arrive at the claimed invention.

Still further, SU '633 alloy includes 0.1 – 0.3% vanadium, and also includes titanium and zirconium. SU'633 thus describes alloys requiring the simultaneous addition of titanium, zirconium and vanadium to improve their creep resistance at high temperatures. Again, it is both difficult and unexpected to achieve satisfactory creep resistance at hot temperatures without harming ductility. In contrast to the alloys described in SU'633, the alloy recited in claim 1 achieves surprising and unexpected improvements in hot creep resistance over the base AlSiCuMg type alloy, while retaining high ductility both at room and at elevated temperatures, without the addition of vanadium.

In summary, SU '633 fails to teach or suggest that the hot creep resistance may be improved while maintaining ductility without the addition of vanadium to the AlSiCuMg type alloy of claims 1 and 21. Furthermore, the alloy recited in claims 1 and 21 is shown to produce both an unexpected and improved hot creep resistance in comparison to what would have been expected for an AlSiCuMg type alloy containing an addition of zirconium without a simultaneous addition of titanium and vanadium. Finally, retaining high ductility in a AlSiCuMg type alloy upon the conscious addition of zirconium is surprising to one of ordinary skill in the art.

For at least the above reasons, SU '633 does not render the present claims obvious. Therefore, applicant respectfully submits that the obviousness rejection over SU '633 should be withdrawn.

Dulin

Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 1, 2, 4-13 and 15-21 under 35 U.S.C. §103(a) as being unpatentable over US Patent No. 2,821,495 (Dulin).

Dulin concerns alloys for high strength structural castings. It is well known to those skilled in the art that a high strength structural component casting as disclosed Dulin (col.4, l 16-17), which is in fact a body structure part of a vehicle, is not comparable to an engine part with high hot creep resistance such as that required for cylinder heads. To reinforce this point, it should be noted that the one example in Dulin concerns a part cast with an AlSi7Mg alloy (AA356) brazed with another cast part and with a wrought product. The scope of the Dulin disclosure, as is clearly stated in all claims of Dulin, is limited to structural components, and very likely parts of an automotive body or chassis. However, the Dulin disclosure surely does not concern an engine part, such as a cylinder head or an engine block.

Moreover, Dulin discloses how to obtain hard and resistant structural cast components, and clearly requires these specific characteristics. It is strongly suggested in Dulin to add (in addition to titanium) zirconium, manganese, nickel, chromium, boron and beryllium, all of which are presented as hardening or refining elements. Contrary to the claimed alloy, Dulin does not teach or suggest the addition of zirconium to copper and magnesium without the addition of the aforementioned hardening or refining elements. Dulin therefore clearly teaches away from the claimed invention. Furthermore, the broad ranges disclosed by Dulin do not teach or suggest the inventive selection of materials and ranges set forth in claims 1 and 21.

In conclusion, Dulin concerns a very different kind of application and fails to teach or suggest that hot creep resistance may be improved by the claimed narrow inventive selection. For at least these reasons, applicant respectfully submits that the obviousness rejection over Dulin should be withdrawn.

New Claims

New claims 22 and 23 depend from claim 21 and recite creep strain performance of the inventive alloys. Applicant submits that claims 22 and 23 further define over the applied prior art.

Conclusion

In view of the above amendment and foregoing remarks, applicant believes the pending application is in condition for allowance. If a fee is due, please charge our Deposit Account No. 09-0528, under Order No. A2402 1090.US, from which the undersigned is authorized to draw.

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Respectfully submitted,

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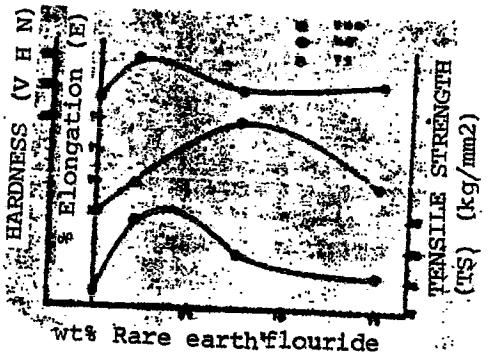

FIGURE 16 : Effect of rare earth fluoride on the mechanical properties of Al + 7.5 % Si -

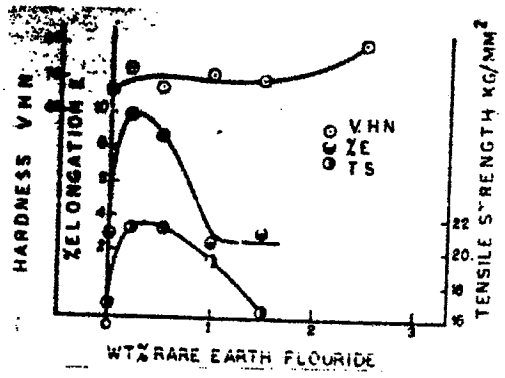

FIGURE 17 : Effect of rare earth fluoride on the mechanical properties of Al + 13 % Si (Metal mold cast) -

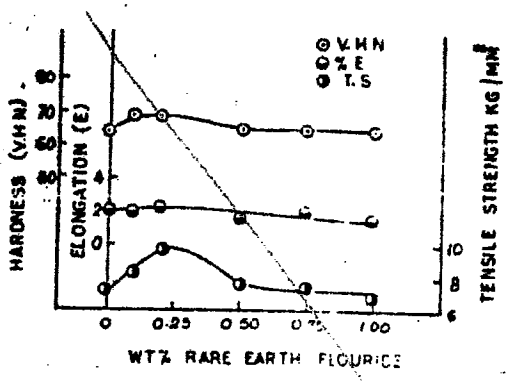

FIGURE 18 : Effect of rare earth fluoride on the mechanical properties of Al + 13 % Si (Sand cast) -

FIGURE 16 (*10*) : l'addition de 0,2 % à 0,75 % de fluorure de MM augmente de près de 40 % la limite élastique qui atteint 18 kg/mm2 et accroît de 5 % à 8 % l'allongement de rupture de l'alliage à 7,5 % de Si coulé en coquille.

FIGURE 17 (*9*) : la charge de rupture et l'allongement de rupture de l'alliage à 13 % de Si coulé en coquille sont augmentés d'une façon importante par l'addition de 0,2-0,5 % de fluorure de MM.

FIGURE 18 (*9*) : le même alliage coulé en sable a une charge de rupture augmentée par l'introduction de fluorure (elle s'accroît de 7 à 10 kg/mm2) tandis que l'allongement ne varie pas.

En résumé, l'introduction de fluorure de MM (0,2-0,8 %) est bénéfique aux alliages hypoeutectiques et aux alliages voisins de l'eutectique coulés en coquille et n'est pas néfaste aux mêmes alliages coulés en sable.

II.5.INFLUENCE DE L'YTTRIUM

On ne dispose, dans ce domaine, que de résumés de documents russes. Tous sont unanimes pour signaler l'augmentation de 10 % environ de la charge de rupture et de 50 % de l'allongement par addition de 0,3 % d'yttrium à des alliages du type Al 7 % Si Mg (*12*) (*11*).

VARNAVSKY (*17*) précise qu'un alliage A-S7G coulé en sable et traité avec du fluorzirconate de potassium et 0,05 % d'yttrium atteint une charge de rupture de 21 kg/mm2 et un allongement de 6,5 %.

Les russes ont également breveté la tenue à chaud de leurs alliages contenant de l'yttrium.

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